May 20, 1941. F. G. MARBACH 2,242,586

METHOD OF MAKING BLOWERS

Filed Feb. 23, 1939 3 Sheets-Sheet 1

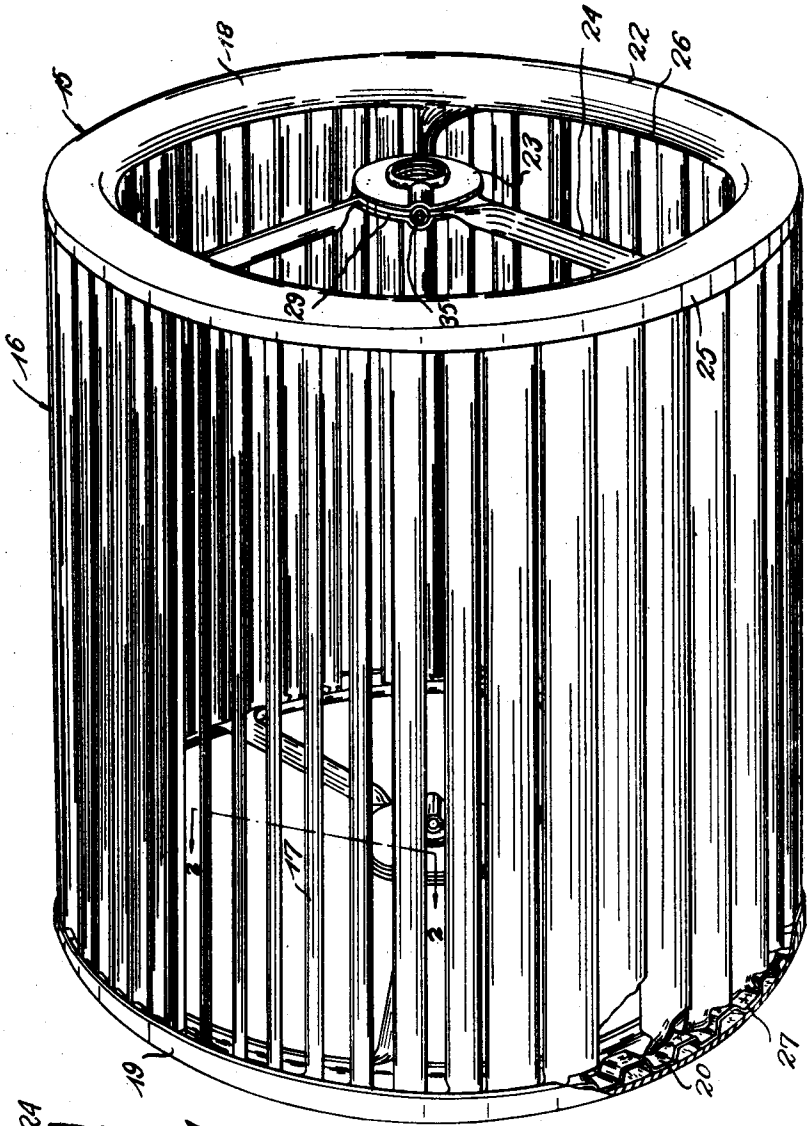


FIG. 1

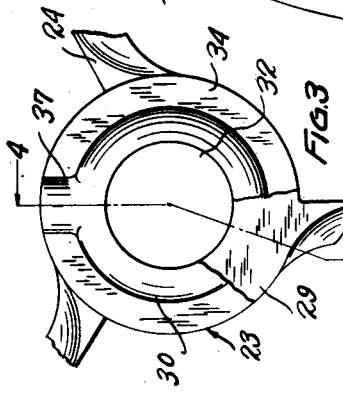


FIG. 3

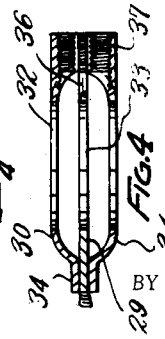


FIG. 4

INVENTOR.
FRANK G. MARBACH
BY
Lewis Hudson & Kent
ATTORNEYS

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METHOD OF MAKING BLOWERS

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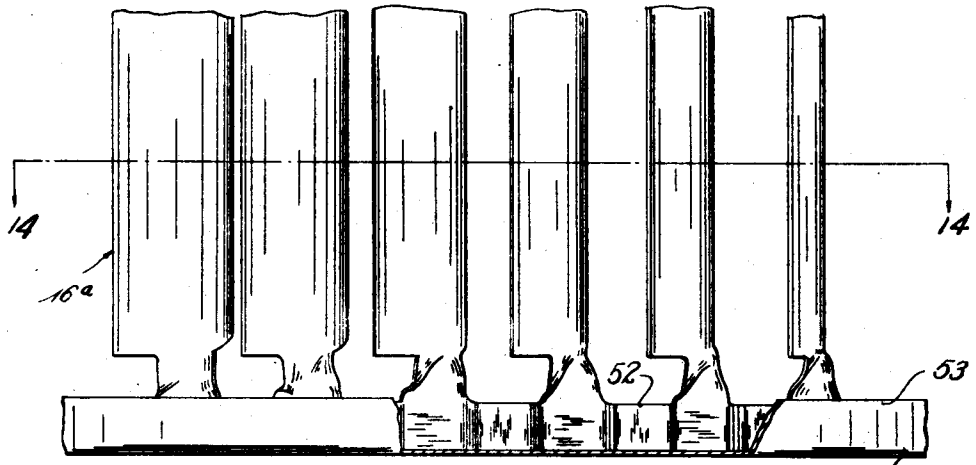


FIG. 13

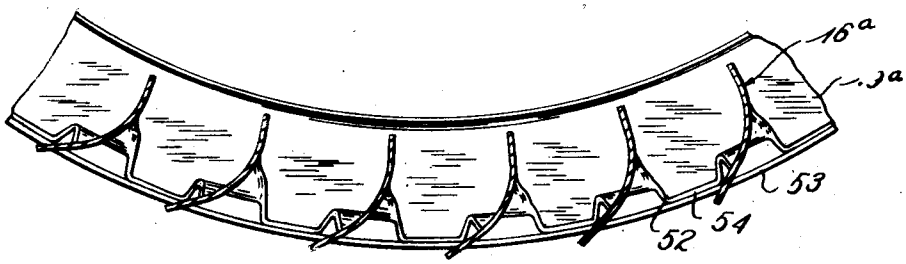


FIG. 14

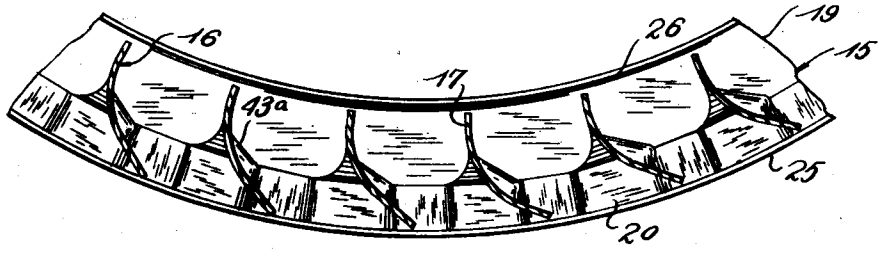


FIG. 2

INVENTOR.
FRANK G. MARBACH
BY Lewis Hudson & Kent
ATTORNEYS

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FIG. 6.

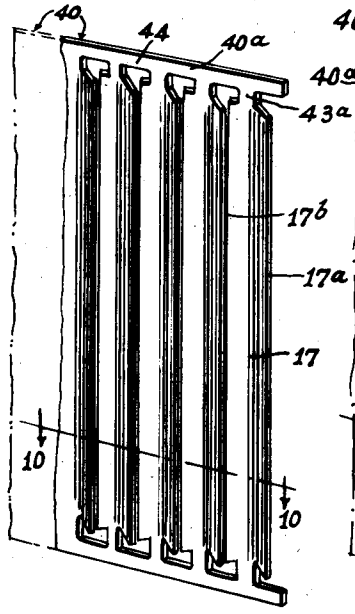


FIG. 7.

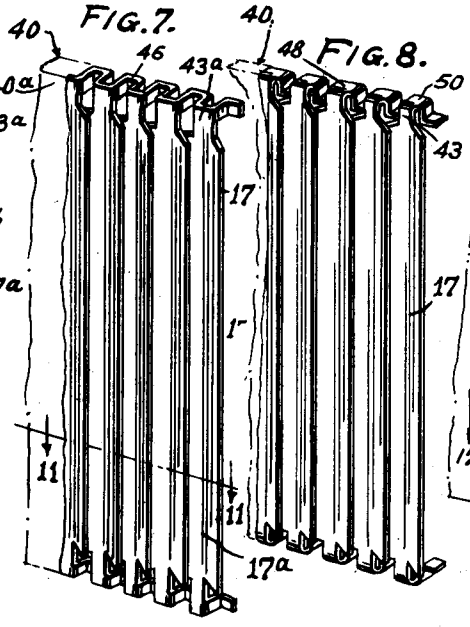


FIG. 8.

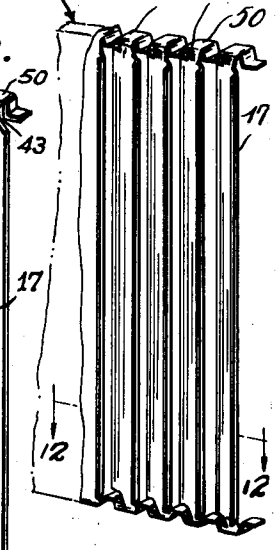


FIG. 9.

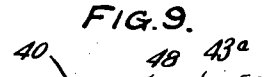


FIG. 5.

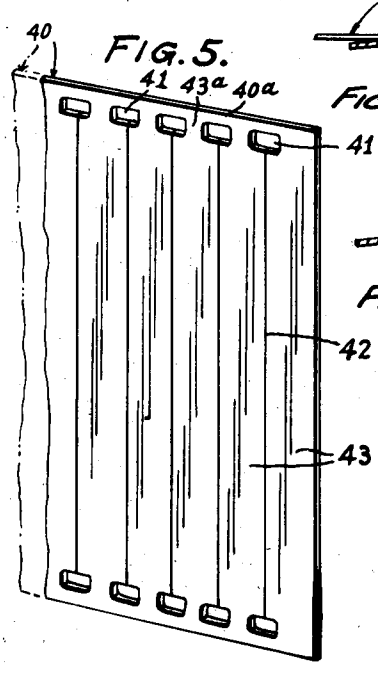


FIG. 10

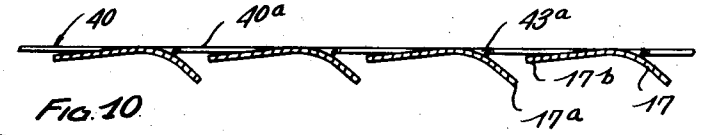


FIG. 11

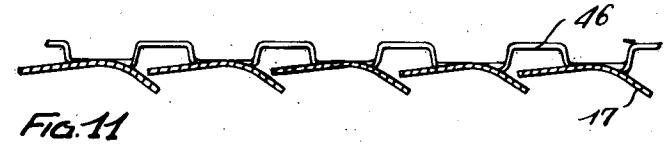
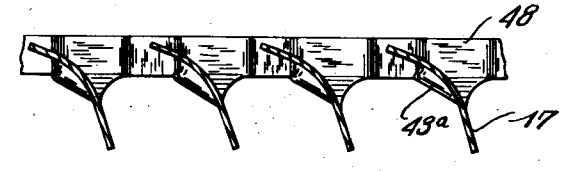


FIG. 12



INVENTOR.
FRANK G. MARBACH
BY Lewis Hudson & Kent
ATTORNEYS

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UNITED STATES PATENT OFFICE

2,242,586

METHOD OF MAKING BLOWERS

Frank G. Marbach, Cleveland, Ohio, assignor to Morrison Products, Inc., Cleveland, Ohio, a corporation of Ohio

Application February 23, 1939, Serial No. 258,009

3 Claims. (Cl. 29—156.8)

This invention has to do with the manufacture of blowers, such as centrifugal blowers, and relates more particularly to a novel method of producing blowers.

An object of my invention is to provide an improved method of constructing blowers in which sheet metal can be used for all of the parts thus enabling the blower to be economically manufactured through the use of stamping operations.

A further object of my invention is to provide a novel method for producing centrifugal blowers in which the blades are formed from a strip of sheet metal so as to remain integrally connected therewith by stems and are then deflected to angular position by twisting of said stems.

Another object of my invention is to provide an improved method of making blowers in which a series of blades is formed on a strip of sheet metal to be subsequently rolled into an annulus and the metal of certain portions of the strip is gathered in a novel manner for decreasing the spacing of the blades so that a larger number of blades can be accommodated in a given circumference.

Other objects and advantages of my invention will be apparent from the following description when taken in conjunction with the accompanying sheets of drawings in which

Fig. 1 is a perspective view, with portions broken away, showing a centrifugal blower embodying novel features of construction and which may be produced by my novel method;

Fig. 2 is a partial transverse sectional view taken on line 2—2 of Fig. 1;

Fig. 3 is a partial plan view of one of the spiders of my blower showing the novel sheet metal hub thereof;

Fig. 4 is a sectional view taken through the hub as indicated by the section line 4—4 of Fig. 3;

Figs. 5 to 9, inclusive, are partial perspective views showing progressive steps of forming a series of blades from a strip of sheet metal;

Fig. 10 is a partial transverse sectional view taken through the strip of Fig. 6 as indicated by section line 10—10;

Fig. 11 is a similar partial transverse sectional view taken as indicated by line 11—11 of Fig. 7;

Fig. 12 is another such partial transverse sectional view taken on line 12—12 of Fig. 9;

Fig. 13 is a partial side elevation showing a modified construction for my centrifugal blower; and

Fig. 14 is a partial transverse sectional view taken through such modified form of blower as indicated by section line 14—14 of Fig. 13.

More detailed reference will now be made to the accompanying drawings in which I have illustrated my improved construction for a centrifugal blower as well as my novel method by which such a blower can be economically manufactured from sheet metal. It will be understood, of course, that the drawings are intended to be illustrative and that the invention is not to be regarded as limited to the particular details of construction and method operations herein disclosed.

In Fig. 1 I show a centrifugal blower 15 embodying my improved construction and which may be produced by my novel method to be described in detail hereinafter. The blower here shown comprises an annulus or cylinder 16 formed of a series of elongated substantially parallel sheet metal blades 17, and a pair of ring structures or spiders 18 and 19 connected with the ends of the annulus and serving both as a stiffening means and a means for mounting the blower on a shaft. As will be explained more in detail hereinafter, the blades 17 are all formed from a single strip of sheet metal by stamping operations performed thereon so as to leave the blades connected with each other along edges of the strip. These connecting edge portions of the strip are crimped or corrugated for the purpose of gathering the metal and thereby reducing the spacing of the blades so that an increased number of blades can be accommodated in a given circumference. The strip containing the blades is rolled or formed into the annulus 16 with the corrugated portions of the strip forming end flanges or rings 20 at the ends of the annulus. These flanges or rings maintain the blades in the desired circumferentially spaced relation and provide a means by which the ends of the annulus can be readily connected with the spiders 18 and 19, as by spot welding or other suitable connecting means, with the blades accurately conforming to the desired cylindrical or annular shape so that very little labor need be performed on the blades after assembly for truing or straightening the same.

The spiders 18 and 19 are preferably formed from sheet metal by appropriate stamping operations and, as shown in the drawings, each spider comprises a rim 22 of channel-like cross-section and a hub 23 connected with the rim by a plurality of radial arms or spokes 24. By constructing the rim 22 of channel-like cross-section, it will be seen that a spider of strong and

rigid characteristics will be obtained and the connection of the spider with the annulus will be facilitated because an end of the annulus can be inserted into the channel recess and in so doing, one or both of the flanges 25 and 26 of the spider may be used as a guide means for locating the blades of the annulus in the desired accurate cylindrical arrangement.

In Fig. 1 I show the annulus 16 formed with the flanges 20 thereof extending outwardly or radially at substantially right-angles to the axis of the blower. With these flanges arranged in this manner it will be seen that they will engage or seat against the end walls of the hollow spider rims and can be connected thereto at spaced points by the spot welding 27 or other suitable connecting means. It is not necessary, however, that these flanges of the annulus be radially extending flanges because they can extend axially of the blower and can be connected with one of the flanges 25 or 26 of the spider rim, preferably the former flange as described more in detail hereinafter and as shown in the modified construction of Figs. 13 and 14.

The arms 24 of the spiders are preferably formed integral with the rims thereof and are beveled or inclined, as shown in Fig. 1, so that they will act as a deflecting means during the rotation of the blower and will facilitate the flow of air into the interior of the blower instead of retarding such flow as they would do if they were flat arms. It will be noted from Fig. 1 that the spiders 18 and 19 are of right and left-hand construction so that for a given direction of blower rotation the arms of both spiders will act to cause a flow of air into the blower through the open ends thereof. It will also be noted that the spiders are connected with the ends of the annulus 16 so that the arms of one spider will be in staggered relation to the arms of the other spider. This arrangement is desirable for securing a more accurate balance and in securing maximum stiffness and rigidity of the blower. When these spiders are connected with the ends of the annulus, as above explained and as shown in Fig. 1, it will be observed that the flanges 25 and 26 of the spider rims extend axially inwardly toward each other so that these rims form end rings for the blower which are smooth and regular in shape.

In Figs. 1, 3 and 4 I show a novel hub construction by which the spiders of the blower can be mounted on or connected with a shaft at points spaced longitudinally thereof to correspond substantially with the planes of the end rings of the blower. The hub 23 is of sheet metal construction and may comprise a central disk portion 29 which is formed integral with the spider arms 24 and with which the inner ends of the latter are connected. Washers or disks 30 and 31 corresponding substantially in diameter with the disk portion 29 are placed against opposite faces of the latter and secured thereto by welding or other suitable means. The washers 30 and 31 are oppositely dished, as shown in Figs. 3 and 4 and are provided with center openings 32 which align with a center opening 33 of the disk portion 29. The dishing of the washers 31 and 32 provides a hub construction of increased thickness or axial length and also provides the washers with circumferential flange or rim portions 34 which can be readily connected with the flat central disk portion 29, as by spot welding.

For connecting the hub 23 with a shaft extending through the aligned openings 32 and 33 I provide a suitable set screw such as the socket headed set screw 35 shown in this instance. To accommodate such a set screw in my sheet metal hub 23 I form the central disk portion 29 with a radial slot 36 therein at the point where the set screw is to be located and form complemental hollow radial ribs or bosses 37 on the washers 30 and 31 to cooperate with the slot in forming a radially extending opening for the screw. As indicated in Fig. 4, the slot 36 extends from the outer edge of the disk portion 29 to its center opening 33. The radial opening may be threaded by forming a screw thread in the curved inner surfaces of the hollow ribs 37 and in the edges of the slot 36 of the central disk portion 29, as shown in Fig. 4.

With the hub and spider construction which I have illustrated and described, it will be seen that the ends of the blower can be mounted on or connected with a shaft at axially spaced points corresponding substantially with the transverse end planes of the blower and, when thus mounted, the blower will not be subject to warping or twisting, nor does any part of the blower project in a free overhanging relation to become distorted or produce vibrations. Moreover, it will be seen that the construction and arrangement which I have provided for the spiders will result in the blower having sufficient stiffness and rigidity to prevent the same from being distorted or losing its accurate shape during shipping or handling.

In Figs. 5 to 9, inclusive, I have illustrated a novel method by which centrifugal blowers of the type shown in Fig. 1 can be economically manufactured by operations performed on strip sheet metal. Fig. 5 shows a strip 40 of sheet metal of appropriate length such that a full set of blades for a blower can be formed thereon and the strip then rolled or shaped into an annulus to bring the blades into their desired cylindrical arrangement. As the first step of my method I punch rows of openings 41 in the strip adjacent the side edges thereof and slit the strip transversely at longitudinally spaced points by cuts 42 extending from one row of openings to the other. Thus the cuts 42 and portions of the openings 41 divide the strip longitudinally into a series of elongated substantially parallel sections 43 for the subsequent formation of blades. As shown in Fig. 5, the ends of the sections 43 remain connected with the longitudinal edge portions 40*a* of the strip by stems 43*a* which are of reduced width, that is to say, are narrower than the sections themselves.

The strip resulting from the punching and slitting just explained above is next subjected to a forming operation in which the sections 43 are bowed or curved transversely thereof and thus partially formed into blades 17. In so shaping the blade sections 43, the edge 17*a* of each section is lifted up with respect to the plane of the strip as shown in Fig. 10 so that during the subsequent metal gathering operation this up-lifted edge can shift into overlying relation to the contiguous edge 17*b* of the adjacent section. During this partial forming of the blades 17, the edges 17*b* may also be lifted somewhat above the general plane of the strip. This partial forming of the blades and lifting of the edge 17*a* to a higher point than the edge 17*b* involves rocking of the sections 43 about their respective longitudinal center lines or axes. This rocking of the sections is accommodated or accompanied by a twisting of the stem portions 43*a* by which the ends

of the sections remain connected with the edge portions 40a of the strip.

During the next forming operation the metal of the portions of the strip by which the blades 17 are connected with each other, in this instance the metal of the edge portions 40a, is gathered for the purpose of reducing the spacing of the blades so that an increased number of blades can be accommodated in a given circumference. The gathering of the metal may be accomplished by crimping or corrugating these edge portions 40a of the strip, as shown in Fig. 7. By comparing the strips shown in Figs. 6 and 7 of the drawings it will be seen that in gathering the metal of the edge portions 40a the bar-like sections 44 which are coextensive with the openings 41 are pressed or drawn in a direction at right-angles to the plane of the strip to form a series of loops or corrugations 46 which are connected with each other by the stems 43a.

For the purpose of stiffening the strip and providing a construction at the ends of the annulus which will facilitate the attachment of the spiders 18 and 19, I may subject the strip to a flanging operation. In this operation the corrugated edge portions 40a are bent over to a position extending substantially at right-angles to the plane of the strip, as shown in Fig. 8, to thereby form the corrugated end flanges 48. This operation may be performed in suitable dies and can be readily carried out by the bending of the metal of the stems 43a on or adjacent the line at which these stems connect with the edge portions 40a.

After the strip has been subjected to this flanging operation it may be subjected to a further blade forming operation in which the blades 17 are curved to their desired final shape and are rocked or twisted to a position corresponding more nearly with the angle at which they are to stand in the completed blower. Figs. 9 and 12 show the strip after the blades have been subjected to this further forming operation, and from these views it will be seen that the blades have been given a more rounded contour and that the stems 43a have been subjected to further twisting.

The strip is next rolled or shaped into an annulus or cylinder by curving the strip substantially uniformly therealong to bring the ends into adjacent or meeting relation. The annulus 16 thus formed is now ready for assembly with the spiders 18 and 19, and this is accomplished by inserting the ends of the annulus into the channel recesses of the rims and connecting the flanges 48 with the latter. As mentioned above, this may be accomplished by spot welding 27 or any other suitable connecting means. When the annulus is formed from a strip having the corrugated end flanges 48 it will have the corrugated radially extending end rings 20, as shown in Fig. 1, and when the ends of the annulus are inserted into the channel recesses of the spider rims these rings will seat against the bottom walls of the channel recesses.

When the ends of the annulus are inserted into the rims of the spiders I find that it is desirable to use one of the flanges of the spider's rim, for example the outer flange 25 thereof, as a guide means or abutment for locating the blades and truing the annulus to cylindrical shape. Since the spiders themselves are accurately formed in metal working dies, the flanges of their rims will be truly circular in form, and hence if the outer edge of the ring 20 is held firmly against the flange 25 while the ring is being welded or otherwise connected to the rim, it will be seen that the annulus will have the desired cylindrical shape after assembly and there will be very little additional work required for straightening or truing the blades.

In forming the corrugations 46 for gathering the metal of the edge portions 40a of the strip I find it desirable to form these corrugations of square or nearly square shape, so that the end flanges 48 and the end rings 20 resulting therefrom will have a series of flat or nearly flat faces 50 thereon. These flat faces provide contact areas which will have substantially flat engagement with the rims of the spiders and will facilitate the forming of the welds 27.

Instead of subjecting the strip to a flanging operation by which the flanges 48 of Fig. 8 are formed, it may be desirable to omit this operation and to form an annulus with straight instead of flanged ends, as mentioned above. In this event the strip shown in Fig. 7 is subjected directly to the further blade forming operation by which the blades are rounded and twisted to the desired condition as described above and substantially as shown in Fig. 12 of the drawings. After this has been done the strip is curved or shaped into an annulus. The spiders are then connected with the ends of the annulus thus formed, and in so doing the ends of the annulus are inserted into the channel recesses of a pair of spiders similar to those shown in Fig. 1. In Fig. 13 I show an annulus 16a which has been formed in this manner, and show an end thereof as having been inserted into the channel recess of the rim of a spider 19a. The corrugated axially extending end ring 52 of the annulus is placed against the inner face of the outer flange 53 of the spider and is connected therewith, by spot welding at the points 54, or other suitable connecting means.

From the foregoing description and the accompanying drawings it will now be readily seen that I have provided an improved construction for centrifugal blowers by which more sturdy and rigid blowers of this type can be produced more accurately and with greater economy of manufacture. In other words with my improved construction and method I can produce a blower having a rigidity comparable to that of a blower of the present day type of construction but which is twenty-five to fifty percent lighter in weight. This is important from the standpoint of economy of material and economy of power where the blower is operated with frequent starting and stopping. It will be seen furthermore that in accordance with my method and improved construction a blower can be formed with a set or series of blades stamped from a single strip of sheet metal, and that sheet metal spiders attached to the ends of the annulus give the blower a desired rigidity and also provide for mounting the blower on a shaft without the use of a center plate and without having overhanging portions of the blower which are usually subject to distortion and frequently cause vibration. Furthermore, it will also be seen that in my improved blower construction the spiders are of right and left-hand construction and the arms thereof facilitate the flow of air into the blower. It will also be seen that the spiders have hubs of novel sheet metal construction which eliminate the need for hubs of cast metal or other more expensive construction.

While I have illustrated my improved blower construction and method in a somewhat detailed

manner it will be understood, of course, that I do not wish to be limited to the details of construction and steps of procedure herein disclosed but regard my invention as including such changes and modifications as do not constitute a departure from the spirit of the invention and the scope of the appended claims.

I claim:

1. The method of making blowers which comprises partially severing a strip of sheet metal transversely at spaced points by punching longitudinal rows of openings adjacent its edges and slitting it from the openings of one row to the openings of the other row to thereby divide the strip into sections having stems connecting them with edge portions of the strip, shaping said sections into blades, gathering the metal of said edge portions at points substantially opposite to said openings and thereby reducing the spacing of the blades, deflecting the blades to an angular position by twisting of said stems, and forming the strip into an annulus.

2. The method of making blowers which comprises partially severing a strip of sheet metal transversely at spaced points by punching rows of openings in the strip adjacent its edges and cutting slits to extend from one row of openings to the other to thereby divide the strip into sections having stems connecting them with edge portions of the strip, shaping said sections into blades, corrugating the strip along edge portions thereof to reduce the spacing of said blades and also flanging said edge portions, deflecting the blades to an angular position by twisting of said stems, forming the strip into an annulus, and connecting ring structures with the flanged ends of the annulus and in the same operation truing the annulus to substantially cylindrical form.

3. The method of making blowers which comprises punching substantially parallel rows of openings in a sheet metal strip adjacent the edges thereof, cutting a series of substantially parallel slits in said sheet to extend transversely thereof and connecting the openings of one row with the corresponding openings of the other row and thereby dividing the strip into a plurality of substantially parallel transverse sections having stem portions connecting them with the edge portions of the strip and extending between pairs of adjacent openings of said rows, curving said sections transversely thereof to shape them into blades and deflecting the same to angular position by twisting of said stems, gathering the metal of edge portions of the strip at points substantially opposite said openings and thereby reducing the spacing of the blades, forming the strip into an annulus, and connecting ring structures with the ends of the annulus.

FRANK G. MARBACH.